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VERMILION LAKE SURVEY

PRIVATE FUNDING SCHEME APPLICABILITY

TOWN OF ONAPING FALLS

1978

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Ministry
of the
Environment

The Honourable
Harry C. Parrott, D.D.S.,
Minister

K.H. Sharpe,
Deputy Minister

Env
R0LD

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ERRATA

Page 15 - Appendix E
Quantity - Percentage should be 21.
Page 16 - Appendix F
Chloride - Percentage should be 3.
Page 17 - Appendix G
Sodium - Numbers and percentage should read as follows:

29	73%
7	17%
4	10%

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VERMILION LAKE SURVEY

PRIVATE FUNDING SCHEME APPLICABILITY

TOWN OF ONAPING FALLS

1978

PREPARED BY

MINISTRY OF THE ENVIRONMENT

Regional Operations & Lab. Division

NORTHEASTERN REGION

MUNICIPAL & PRIVATE ABATEMENT SECTION

SUDBURY

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INTRODUCTION

The Regional Municipality of Sudbury - Ministry of the Environment Liaison Committee determined that several areas located within the Region would benefit from a Private Funding Scheme recently introduced by the Environment Ministry.

Vermilion Lake was considered a priority since it had the highest population density, was located on a recreational waterbody, and could not be serviced by connection to an existing communal system.

The Private Funding Scheme was established as a low cost-effective alternative to communal services (both sewer and water) and could be applied to renew or repair existing systems on a lot by lot basis.

In order to establish the acceptability of the request to receive funding, health and/or environmental problems must be identified by assessing water quality and quantity, and the quality of sewage systems on an individual basis.

VERMILION LAKE AREA

Location

The survey area is situated along the north shore of Vermilion Lake approximately 45 km west of the City of Sudbury and is located entirely within Fairbanks Township, Town of Onaping Falls, near Chelmsford. Access is via Highway 144 North to the Vermilion Lake Road.

Development extends 2.0 km east and west along the shoreline of the lake and consists of 133 seasonal and permanent residences. Due to the nature of the funding scheme, only permanent residences are applicable for grants. Therefore only the 59 permanent residences are reported upon in this survey.

Topography

The community is located approximately 2 m above water level in a bedrock-drift complex. The western portion is largely exposed bedrock or very thinly drift-covered bedrock. The remaining portion is entirely composed of pleistocene glacio lacustrine deposits of clay and silty clay.

There is little relief with exception of a bedrock ridge located north and east of the residential area. The ridge causes drainage to flow predominantly to the south and restricts the groundwater recharge potential of the area.

The residences are primarily located on a clay flat, and water well records indicate that bedrock starts within 0.5 m from surface. Yellow grey and blue clays overlie the bedrock with an average 5 m depth.

The predominance of clay seriously restricts groundwater recharge because of poor infiltration and the reduced pore size does not allow a productive aquifer.

Survey Procedures

Between June 22 and August 14, 1978, 102 of the 133 residences were inspected. However, the funding scheme is applicable only to permanent residences, of which 57 out of 59 were completed. Therefore, this report will discuss only the relevant properties.

At each inspection, the home owner/tenant was interviewed using the appended survey questionnaire (Appendix H). In order to identify each residence, hydro numbers were recorded as the reference or property number (Appendix I). Data on property size, type, age and the relative location of wells and sewage disposal systems was collected. References to drainage characteristics, local topographic features and soil type were made. Complaints concerning water quality and quantity, although subjective, were also logged. At the time of inspection, a plot plan indicating the general layout of the property was completed on the back of the survey form and comments on malfunctioning systems were recorded.

If the residence utilized a groundwater source, bacteriological and chemical samples were collected. Bacteriological examinations were completed at the Ministry of Health Laboratory in Sudbury. Chemical analyses were completed at the Thunder Bay and Toronto Environment Laboratories. Parameters measured included hardness, alkalinity, iron, chlorides, pH, colour, turbidity, conductivity, potassium, sulphates, nitrates, manganese and sodium.

Because of the relative flatness of the residential area and dry weather conditions, no surface (ditch) water was available for sampling.

QUESTIONNAIRE RESULTS

Sewage Disposal

Of the 57 permanent residences surveyed, 41 (71%) reported to have septic tank and tile field systems, 7 (12%) had pit privies, 9 (15%) had holding tanks and 1 (2%) was serviced by a leaching pit (Appendix A).

System ages ranged from less than one month to greater than 15 years. A majority (59%) of the septic tank/tile field systems were less than 5 years old and would therefore meet present regulations under The Environmental Protection Act, 1971 (Appendix B).

The visual observations made at each property did not uncover any evidence of malfunctioning sewage systems with the exception of one washwater discharge to the ground surface. However, on several properties it was apparent that tile field areas were too small under present regulations, but no obvious surface signs of problems were observed.

Water Supply Sources

Of the 39 private wells, 24 (62%) were drilled, 14 (36%) were dug and one (2%) was a point. Thirteen homes (23%) took water directly from Vermilion Lake, 1 (2%) hauled water from Chelmsford, and 1 (2%) source remained unknown (Appendix C).

Ages of the wells ranged from less than 1 year old to greater than 15 years. The majority (56%) were 5 or less years old (Appendix D).

Well Water Quantity and Quality

The well owner's opinion of the amount of groundwater available was taken from the questionnaire data. Nine (23%) of the well owners complained of seasonal or yearly shortages. Over 66% of the supplies with quantity problems were dug wells.

The majority of complaints concerned iron, hardness, taste and odours. Twenty-eight (67%) of the area residents reported at least one type of problem with their water supply.

Seven owners used some form of water filtration treatment; one residence used a softener and another an iodinator (Appendix E).

POTABLE WATER SAMPLE RESULTS

Bacteriological

Results indicated that 14 (36%) of the well samples contained coliform organisms. Nine (23%) of these contained fecal coliform organisms, the presence of which suggests sewage contamination.

Of the 14, 57% were observed in drilled wells which were relatively shallow. The deep wells, greater than 120 feet, appeared to be only slightly contaminated with total coliform counts.

Fecal contamination, with one exception, was restricted to aquifers less than 80' in depth. It appears that the deeper aquifers have not been affected.

Of the 14 total coliform counts, 3 could be considered insignificant because of the very low 2-0 total and fecal coliform counts.

Well owners were immediately contacted if adverse bacteriological samples were obtained from their supply.

Chemical Quality

Chemical results are summarized in Appendices F and G.

Analyses indicated that 33 (82%) of the groundwater samples contained excess hardness (> 180 mg/L) and iron (> 0.3 mg/L).

Manganese levels surpassed the permissible limits in 32 (80%) of the samples. Both iron and manganese contributed significantly to the elevated colour (68%) and turbidity (88%).

Mean values of various parameters are given in Appendix G. Although the aquifers presently being used in the area are aesthetically undesirable, no chemical constituents considered to be hazardous to health were found in concentrations considered to be a problem over the entire area. Two individual well owners whose supplies contained excess nitrate were immediately informed by letter of the associated health hazard (see Glossary) if the water is being consumed by formula-fed infants under three months of age.

CONCLUSIONS

Based on the 14 wells with coliform pollution and the 2 supplies with excessive nitrate levels, a Private Funding Scheme may be applicable to correct these problems in the Vermilion Lake area. There was no evidence to support the scheme based upon malfunctioning sewage disposal systems, although property size restrictions, reported ages, and the heavy clay soil type should severely tax efficient subsurface sewage disposal.

Although the groundwater in the area is aesthetically displeasing, there is no provision in the scheme to offer financial assistance unless there are associated health hazards.

Cost Estimates

A cost effective means of ensuring bacteriologically acceptable well water for residences where well water was found to be unacceptable, would be hypochlorination. Well relocation and sewage disposal system upgrading or replacement to ensure safe water requires substantial costs because of the clay nature of the soil and relative shallow depth to bedrock.

Alternative 1: Individual well disinfection by means of a domestic hypochlorinator can be purchased and installed for \$280.00 per unit. For the 14 affected wells, corrections could be instituted for a total of \$3,920.00

Alternative 2: The affected wells can be replaced by re-locating to a new drilled well. Assuming the cost of a new drilled well in this vicinity to be \$4,500.00, the total cost for 14 new wells would be \$63,000.00

From the above estimates, alternative number 1 is the most cost effective.

The correction of the two supplies containing nitrates (locations 132 and 84) require either well relocation or the installation of treatment systems i.e. reverse osmosis. Either approach would cost approximately \$10,000.00

In summation, the total costs for all corrections would be approximately \$14,000.00. Based upon a grant of 75% under the Private Funding Scheme, a total grant of \$10,500.00 might be made available to the municipality for correction.

Appendix A

SEWAGE DISPOSAL SYSTEM TYPES

TYPE	NUMBER	PERCENTAGE OF THE TOTAL
Septic tank and tile fields	41	71%
Pit Privies	7	12%
Holding Tanks	9	15%
Leaching Pits	1	2%
Total	58 systems	100%

Appendix B

SEWAGE DISPOSAL SYSTEM AGES

Age	SEPTIC TANKS & TILE FIELDS		PIT PRIVIES		HOLDING TANKS	
	#	%	#	%	#	%
0-5 years	24	59	1	14	8	89
6-10 years	9	22	0	0	1	11
11-15 years	2	5	0	0	0	0
> 15 years	0	0	1	14	0	0
Unknown	6	14	5	72	0	0

Appendix C

WATER SOURCE INFORMATION

TYPE	NUMBER REPORTED	PERCENTAGE OF THE TOTAL
Drilled Wells	24	44%
Point Wells	1	2%
Dug Wells	14	26%
Hauled Water	1	2%
Lake Water	13	24%
Unknown	1	2%

NOTE: 2 drilled wells and 1 dug well are shared.
∴ percentages are based on a total of 54
residences.

Appendix D

GROUNDWATER SOURCE AGES

AGE	NUMBER	PERCENTAGE OF THE TOTAL
0-5 years	22	56%
6-10 years	7	18%
11-15 years	1	3%
> 15 years	1	3%
Unknown	8	20%
Total	39 groundwater sources	100%

Appendix E

REPORTED GROUNDWATER PROBLEMS

(out of 42)

REPORTED PROBLEM	NUMBER REPORTED	PERCENTAGE OF THE TOTAL
Taste	9	21%
Odour	8	19%
Colour	5	12%
Hardness	27	64%
Iron	28	67%
Quantity	9	23%
Filters Used to minimize problems	5	12%

Appendix F

CHEMICAL ANALYSIS EXCEEDING THE

M.O.E. CRITERIA

(out of 40)

PARAMETERS	NUMBERS EXCEEDING M.O.E. CRITERIA	PERCENTAGE OF THE TOTAL
Iron	33	83%
Chloride	1	39%
Colour	27	68%
Turbidity	35	88%
Sodium	15	38%
Sulphate	0	0%
Nitrate	2	5%
Manganese	32	80%

M.O.E. STANDARDS FOR CHEMICAL PARAMETERS

<u>Type</u>	<u>Concentrations</u>
Nitrate	10 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Colour	5 Hazen Units
Turbidity	1.0 Formazin Units
Sodium	20 mg/L

Appendix G

CHEMICAL ANALYSIS RESULTS

(out of 40)

PARAMETERS	RANGE	NUMBERS	PERCENTAGE OF THE TOTAL	AVERAGE (mg/L)	M.O.E. CRITERIA
Nitrate	0.0-5.0 mg/L	37	93%	2.13	10.0 mg/L
	5.1-10.0 mg/L	1	2%		
	> 10.0 mg/L	2	5%		
Iron	0.0-0.3 mg/L	9	23%	1.80	0.3 mg/L
	0.31-1.0 mg/L	10	25%		
	> 1.0 mg/L	21	53%		
Manganese out of 39 (1 exhausted)	0.0-0.5 mg/L	2	5%	0.8	0.05 mg/L
	0.051-1.0 mg/L	27	59%		
	> 1.0 mg/L	11	28%		
Colour	0.0-5.0 H.U.	15	38%	23.6 Hazen Units	5.0
	5.1 - $\geq$ 70 H.U.	25	63%		
Turbidity	0.0-1.0 F.T.U.	5	13%	14.3 Formazin units	1.0
	1.1-10.0 F.T.U.	16	40%		
	> 10.0 F.T.U.	19	47%		
Sodium	0.0-20.0 mg/L	24	71%	23.9	N/A
	21.0-50.0 mg/L	7	21%		
	> 50.0 mg/L	3	9%		

COMMUNITY: _____

18

INFORMATION RECEIVED FROM: _____

Appendix H

SURVEYED BY: _____

SAMPLE INFORMATION

Type	Bacteriological	Chemical
Sample No.		
Sample Location		
Results	Total	Faecal

PROPERTY INFORMATION

Name of Owner _____ Owner's Phone No. _____
 Permanent Address _____

Name of Resident _____

Lot No.	Conc.No.	Township	Community	Street Address	Phone No.

Size of Lot	Drainage	Topography	Soil Type

No. of Residents	No. of Bedrooms	Laundry Facilities	Other

SEWAGE DISPOSAL SYSTEM

Type	Septic Tank _____ Tile Bed _____ (enter distances)	Leaching Pit	Pit Privy	Other (Specify)

Age	Distance to Surface Water	Distance to Water Supply

Comments: _____

Note Quantity

WATER SUPPLY

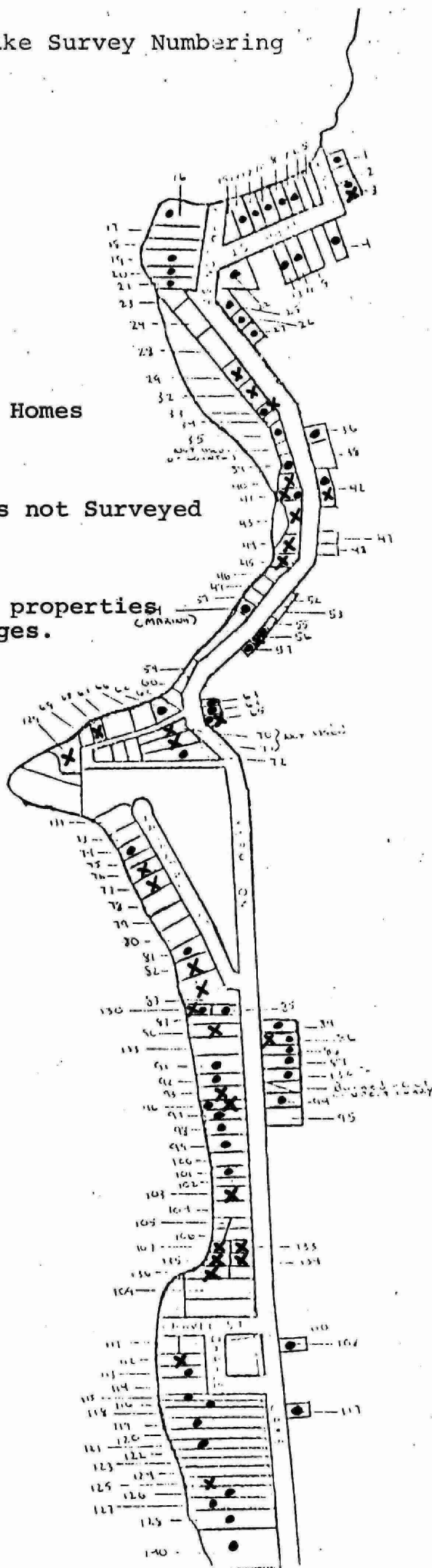
Type	Surface Water	Dug Well	Drilled Well	Cased Well	Point

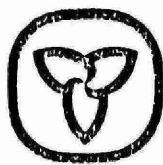
Depth	Age	Type & Capacity of Pressure System	Type of Pipe	Chlorinator	Filtration
Comments:	Taste	Odour	Colour	Iron	Hardness
			Quantity	Quality	

DIAGRAM ON REVERSE SIDE SHOWING LOCATION AND DISTANCES FOR WATER SUPPLY AND SEWAGE DISPOSAL.

- Permanent Homes
- X Properties not Surveyed

Remaining properties are cottages.





Ontario

Appendix J

Ministry of the
Environment

Northeastern
Region

Regency Mall
469 Bouchard St.
Sudbury, Ont.
P3E 2K8
(705) 522-8282

1978 07 18.

Dear Sir:

Re: Vermilion Lake - Private Funding Survey.

The Ministry of the Environment is presently conducting a residential well water and sewage disposal survey at Vermilion Lake. When staff called at your home you were not available for comment.

Please phone 522-8282 to arrange a re-visit.

Yours very truly,

LWM/hc/5658

L. W. Maki,
Environmental Officer,
Municipal & Private Abatement.

GLOSSARYA. BACTERIOLOGICAL EXAMINATIONS1. Coliform Bacteria

The direct search for a specific pathogen in water is too uneconomical and slow for routine control purposes. Instead water is examined for an indication of fecal contamination by using specific groups of bacteria as indicators. When these groups are found in the water it is assumed that the water is potentially harmful. The standard group of micro-organisms used as an indicator is the coliform group which includes all aerobic and facultative anaerobic, Gram-negative, nonspore forming, rod-shaped bacteria that ferment lactose with gas formation within 48 hours at 35°C. Organisms of the *Escherichia coli* strains which are usually of fecal origin, and of the intermediate and *Aerobacter aerogenes* strains which are usually but not always of soil, vegetable, or other non-fecal origin are included in this group.

1 (a) Total Coliforms

This group comprises species that are commonly associated with fecal matter (human and animal) and normal inhabitants of soil and vegetation. The presence of total coliforms in water may indicate contamination from soil runoff, or, less recent fecal pollution.

1 (b) Fecal Coliforms

These bacteria are mainly species associated with human and animal fecal matter. The presence of fecal coliforms in water indicates a relatively recent and near pollution input.

B. CHEMICAL ANALYSES

1. Alkalinity

Alkalinity is the measure of the power of a solution to neutralize hydrogen ions. It is used to define the buffering capacity (the capacity to resist changes in pH) of water. Alkalinity is expressed in terms of an equivalent amount of calcium carbonate. This does not necessarily imply that there is this much calcium carbonate in the water or that there is any at all. The alkalinity measurement represents the quantity of acid, expressed as calcium carbonate, needed to reduce the pH of a measured portion of sample 4.5. It is caused by the presence of carbonates, bicarbonates, and hydroxides, and to a lesser extent by the presence of borates, silicates, phosphates, and organic substances. Alkalinity is not considered detrimental to human health but it is generally associated with high pH values, hardness and excessive dissolved solids.

2. Colour - Apparent

Apparent colour includes colour due to dissolved solids and suspended matter. Surface water colour is due mostly to the presence of humic acids derived from decomposition of plant material. In groundwaters colour is usually due to the presence of iron and manganese. Most naturally coloured water (usually yellowish-brown) is harmless. The objective for domestic water supplies in Ontario is 5 Hazen Units.

3. Chloride

Chloride concentrations in water supplies may result from contact with natural minerals, industrial and agricultural wastes, or human and animal sewage. Urban runoff often contains high concentrations of chloride in the winter due to the application of road salt. Chlorides are generally not harmful. Allowable concentrations in drinking water are based on palatibility requirements rather than on health considerations. The water quality objective for domestic drinking water supplies in Ontario is 250 mg/L.

4. Conductivity

Conductivity is defined as the reciprocal of a water's electrical resistance (in ohms) between two electrodes one square centimeter in area and one centimeter apart at a standard temperature at 25°C. It is a measure of the ion concentration in water. In natural waters conductivity is mainly due to calcium, magnesium, sodium, potassium, bicarbonate, chloride, sulfate, and nitrate ions. Conductivity can be correlated with dissolved solids content. In Ontario the dissolved solids content is equal to 0.65 ± 0.10 times the conductivity. The permitted level for conductivity in drinking water in Ontario is indirectly established by the limit for dissolved solids.

5. Hardness

Hardness, defined as the soap neutralizing power of water, can be expressed in terms of an equivalent concentration of calcium carbonate. Hardness is mainly attributable to the presence of calcium and magnesium ions resulting from the natural accumulation of salts during contact with soil and geological formations. Hardness is objectionable because it reduces the efficiency of soap and it can produce scums and scales. Hardness in drinking water is limited indirectly by the criteria for dissolved solids (maximum of 500 mg/L). Concentrations over 120 mg/L become increasingly inconvenient.

6. Iron

Iron is the most abundant of the heavy metals in nature but despite this abundance it is generally found in relatively low concentrations in natural surface waters. In groundwater, however, conditions may be such that high concentrations of iron remain in solution. Iron concentrations occur in water due to the leaching of soluble iron salts from soil and rocks. Iron is non-toxic even at high concentrations but becomes objectionable in water because of the taste and odour it imparts. It also tends to precipitate as hydroxides staining laundry and porcelain fixtures. Also, ferric iron combines with the tannin in tea to produce a dark violet colour. The water quality objective for drinking water in Ontario (0.3 mg/L) is based on aesthetic and taste considerations.

7. Manganese

Manganese is a common element in nature and found in numerous minerals which include pyrolusite, braunite, manganespat. It is essential in trace quantities for the proper nutrition of both plants and animals. Although manganese is non-toxic at levels commonly encountered in water supplies, it can cause unpleasant tastes and stain laundry and plumbing fixtures. Iron and manganese are commonly found together.

8. Nitrate Nitrogen

Nitrates are the end products of the aerobic stabilization of organic nitrogen and as such they occur in polluted waters that have undergone self-purification. They can occur in groundwater as a result of leachings from cesspools or fertilized soil. Photosynthetic action is constantly utilizing nitrates and converting them to organic nitrogen in plant cells but in groundwater this action is not possible and high concentrations of nitrates can result. Nitrates are undesirable because their nutritive properties promote the growth of algae and other aquatic plants. Although nitrates are considered non-toxic to adults, high levels in domestic water supplies can lead to a condition known as infant methemoglobinemia in which the oxygen carrying capacity of the blood is inhibited. The maximum acceptable level of nitrates for domestic water supplies in Ontario is 10 mg/L if the water is to be used for infant feeding.

9. pH

The symbol pH is used to designate the logarithm (base 10) of the reciprocal of the hydrogen ion activity. In the case of natural waters the hydrogen ion activity closely approximates the hydrogen ion concentrations in moles per litre. Although the hydrogen ion is a potential pollutant in itself, pH is also intimately related to the concentrations of many other substances. The degree of dissociation of many substances is influenced by pH and since the undissociated compounds are frequently more toxic than the ionic forms pH may be a highly significant factor in determining limiting concentrations. Also the hydrogen ion concentrations is important because it affects the taste and corrosivity of water and the efficiency of chlorination.

10. Sodium

Sodium ranks sixth in the natural order of elemental abundance and is normally the principal ion in brackish or saline groundwater. It is important for all life forms and is generally considered non-toxic. Patients with high blood pressure however are usually warned to avoid the consumption of water containing high concentrations of sodium. Waters softened by the ion-exchange process employed in most domestic water softening equipment, generally contain high levels of sodium.

11. Sulfates

Sulfates occur naturally in water as a result of leachings from minerals. Sulfates may also occur as the final oxidized stage of sulfides, sulfites, and thiosulfates, as the oxidized state of organic matter in the sulfur cycle and as a result of industrial wastes. Water high in sulfates tends to form hard scales on plumbing and increase the corrosiveness of water towards concrete. Under anoxic conditions sulfates serves as an oxygen source for bacteria which convert it to hydrogen sulfide gas. The maximum sulfate concentrations permissible for domestic water supplies in Ontario is 250 mg/L. Although the limit is not based on taste or physiological considerations, concentrations over the limit may exert a cathartic effect on the gastro-intestinal tract.

12. Turbidity

Turbidity is a measure of the optical properties of a water sample. It is attributable to suspended and colloidal matter which diminishes the penetration of light. Turbidity is useful in assessing water clarity. In Ontario turbidity is measured in Formazin Units.



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